PUBLIC DOCUMENT . . . . . No. 50.

Commonwealth of Massachusetts.

REPORT OF THE COMMISSIONERS

ON THE

TOPOGRAPHICAL SURVEY.

FOR THE YEAR 1895.

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REPORT.

BOSTON, Dec. 31, 1895.

To His Excellency FREDERIC T. GREENHALGE,
Governor of Massachusetts.

The Commissioners on the Topographical Survey and Map and the determination of the boundary lines of the cities and towns of the Commonwealth hereby present their report of the work relating thereto executed under their direction during the year 1895 now closed.

The general plan of operations has been, of necessity, somewhat modified from that pursued during the preceding year of 1894.

As stated in their previous reports, the method, particularly of the field work, has been to commence and carry it forward, in as regular progress as practicable from the bases afforded by the already provided triangulation of the United States Coast and Geodetic Survey, bordering on the seacoast and proceeding westwardly into and through the interior sections of the State.

This plan has been substantially followed up to and including the last field season, of 1894, and the boundary surveys of the cities and towns in

the eastern part of the State completed to about the easterly boundary of Worcester County.

Some field work was undertaken in Berkshire County, in 1892 and 1893, which proved, however, to involve more difficulties as an independent survey than would be likely to occur if brought into the general scheme of more regular progress work. The field party was therefore withdrawn from this locality, and the survey, for the time being, suspended.

In connection with the preparation of the State map, when the parties of the Geological Survey took up the topography of the Connecticut River valley, in 1885, the points of the Borden and coast surveys were found too far apart to afford practicable bases for the detailed surveys, and, on application of the commissioners, a party of the Coast and Geodetic Survey, in charge of Assistant F. W. Perkins, was directed, under the law of Congress authorizing that department to furnish triangulation points to States making a topographical or geological survey of their territory, to make good this deficiency. In executing this work Mr. Perkins recovered and re-established a number of the main points of the former Borden and coast survey triangulation, Mt. Tom and Mt. Holyoke among them. In addition to these, he determined one hundred and twenty-six secondary points, as

bases for the topography ; having also in view the boundary line surveys of the cities and towns along the river valley.

In explanation of the general project of the present season's work, your commissioners beg leave to repeat the statement made in their last report, in regard to the necessity for what may be termed a special primary triangulation, in advance of, and as a basis for, the more detailed determination of the points in the city and town boundaries. They quote as follows: —

"The surveys of the commission have thus far been aided and controlled by the previous triangulation of the United States Coast and Geodetic Survey, together with such points of the Borden survey as could be identified. As the State survey has extended farther inland, the points have become not only less frequent, but have also changed in character and position from what is termed 'secondary' to 'primary triangulation.' The former is more in the nature of detail work, and is used as a basis for topography; and the latter is the skeleton work of the larger scheme of the government survey, and includes such stations as Blue Hill in Milton, Prospect Hill in Waltham, Holt's Hill in Essex County, Wachusett in Worcester County, Mt. Tom in Hampshire County, Greylock, Perry's Peak and Mt. Everett in Berk-

shire County, with Unkonoonuc and Monadnock in New Hampshire, and Beaconpole and Bald Hill in Rhode Island and Connecticut near the boundary line of Massachusetts. This series of primary triangles are separated by distances of from thirty to forty miles. To observe and measure these long lines a larger class of signals and more powerful instruments, often supplemented by the use of the *heliotrope*, are required than is necessary in the more detailed determination of points in the city and town boundary lines."

The necessity for such a primary triangulation was felt at the close of the last season's field work, which had been carried forward, westward, from the last available base, the line between Blue Hill and "Prospect Waltham," as far as the system of secondary triangulation made it suitable to go. As already stated, this left a large area of country, between the last-named base points — Blue Hill and Prospect Waltham — and the points of the Connecticut River triangulation determined in 1885, unprovided with sufficient triangulation. Provisional arrangements for this work were made during the last season, with the intention of assigning it to Mr. C. H. Van Orden. His recall to duty on the Coast and Geodetic Survey, however, prevented its execution. Previous to this change of official duty, which occurred in April, 1895, Mr.

Van Orden remained with the commission in charge of office and other technical work. Since the above-named date Mr. Van Orden has responded to the request of the commissioners to make certain inspection of the field work and the computation of its results, the particulars of which will be given further on in our report.

The change of usual programme in the order of field work, referred to at the commencement of this report, has been, in the main, as follows: —

A primary triangulation, between the base line Blue Hill to Prospect Waltham and the triangulation of 1885 in the Connecticut River valley, has been assigned to Mr. James B. Tolley, and the determination of the boundary lines of the cities and towns in the same valley assigned to Mr. E. E. Peirce; this latter work, commencing at the State boundary line with Connecticut, has been carried northward in regular progress.

The boundary survey in the south-eastern part of Worcester County, conducted last season by Mr. W. C. Hawley, has been suspended, awaiting the completion and computation of the primary triangulation by Mr. Tolley, above referred to. Mr. Hawley has been assigned to work in the office in revising and continuing the computation of field results.

Since their last report, two acts of the General Court have been passed assigning to the commission the duty of locating and defining the boundary lines between the city of Waltham and the town of Lexington, and between the towns of Melrose and Stoneham. Your commissioners beg leave to recite the reports on these two matters, which have been submitted to His Excellency the Governor and to the respective officials of the city and towns in question. The report on the boundary line between the city of Waltham and the town of Lexington is as follows: —

COMMONWEALTH OF MASSACHUSETTS.

TOPOGRAPHICAL SURVEY COMMISSION,
OFFICE, COMMONWEALTH BUILDING,
11 MT. VERNON STREET, BOSTON.

To His Excellency FREDERIC T. GREENHALGE,
Governor of Massachusetts.

Your commissioners beg leave to present the following report in reference to the requirements of an act of the General Court below cited, as follows: —

[CHAPTER 229, ACTS OF 1895.]

An Act to locate and define the Boundary Line between the City of Waltham and the Town of Lexington.

SECTION 1. The commissioners on the topographical survey and map of Massachusetts,

after hearing parties interested, upon proper notice, are hereby authorized and directed to locate and define the true boundary line between the city of Waltham and the town of Lexington, and to mark said boundary line by appropriate monuments. The boundary line thus located and defined shall be the true and correct boundary line between the said city of Waltham and the said town of Lexington.

SECT. 2. This act shall take effect upon its passage. [*Approved March 27, 1895.*

In execution of the work assigned to them the commissioners gave due notice to parties interested of a hearing to be given by their board at the city hall in Waltham, on Wednesday, the 15th of May current.

At this hearing various statements were made in regard to the location and marking of the points defining the boundary line between the city of Waltham and the town of Lexington.

Reference was made to the establishment of this line as far back as 1635, defined at one end by a "poplar tree" on the north-west shore of the "Great Fresh Pond," and, "from the tree up into the country north-west by west upon a straight line by a meridian compass." No evidence was given as to more definite data affecting the initial points or the direction of this line

of boundary; and, further than this, on examination of the ground in question the commissioners were unable to determine either the initial points or the direction of the line referred to.

The identity and correct position of the initial points of the boundary line between Waltham and Lexington, as at present marked and defined, were questions; but testimony was given as to the permanent existence of the position of these points and the monuments marking them during the last thirty-four years, and other testimony certifying to fifty-five years.

Another question of boundary was raised in reference to the location and extent of a tract of land said to be within the territory of the city of Waltham, and formerly belonging to Matthew Bridge. No definite evidence was given as to the location, extent or marking of this tract of land. The question of boundary, however, involved both legislative and municipal action in relation to this tract of land, and the commissioners deemed it their duty to investigate fully the legal bearings of the case, and to this end referred the matter to a professional conveyancer, who reported as follows: —

"As the result of my investigation of the contention between the towns of Lexington and Waltham, I beg leave to report that, so far as

appears of record, I am unable to definitely locate what is commonly known as the 'Matthew Bridge Farm.' There is, however, no doubt but that the property is located within either the limits of the present city of Waltham or the town of Belmont, and is not a part of the town of Lexington.

"Originally that part of the country now called Lexington was known as the North Parish of Cambridge, and was set off as such Dec. 16, 1691, being described as follows: 'Beginning at the first run of water or swamp place, over which is a bridge or way, on the south side of Francis Whittemore's house, towards the town of Cambridge, across the neck of land between the Woburn line and that of Watertown, upon a south-west and north-east course.'

"On the twentieth day of March, 1712, the North Parish of Cambridge was incorporated as the town of Lexington. Matthew Bridge was the first town clerk of that town.

"On the twentieth day of March, 1755, Matthew Bridge petitioned the General Court as follows: 'That he is very inconveniently situated for attending public worship of God in either of the meeting-houses of Cambridge, and much more commodiously situated for the meeting-house in Waltham, and prays that he and his estate may be set off to the town of Waltham,' which petition

was granted June 1, 1755, in which decree it also appears that the estate of Matthew Bridge comprised some fourteen or fifteen acres.

"On March 18, 1859, the town of Belmont was incorporated, being comprised of certain portions of the towns of Watertown, Waltham and West Cambridge, in the description of which is set forth the fact that the north-westerly boundary line of the town of Belmont runs to a certain stone post; 'said post being at the extreme south-east corner of Lexington,' from which the inevitable conclusion must be that, as Lexington was set off from Cambridge in 1712, which was forty-three years prior to the filing of the petition of Matthew Bridge to have his property incorporated into the town of Waltham, which property, at that later date set forth as being in Cambridge, must have been in that portion of Cambridge not set off as Lexington; and as there does not appear to have ever been any change made in the boundary line between Lexington and Waltham since the incorporation of the former in 1712; and as the north-westerly line of Belmont, defined by the statute of 1859, ran up to the Lexington line, — the farm of Matthew Bridge must have been in that part of Waltham adjoining Cambridge which was absorbed by the formation of the town of Belmont, and is to-day a part of that town.

"Therefore, as the duty of your Board is to define the line between Lexington and Waltham only, I fail to discover any reason why you should consider the question of title to the Bridge farm at all, it being entirely within the town of Belmont."

After due consideration of all the evidence given in the case, your commissioners are of the opinion that there is not sufficient cause for changing the position of the bounds already in existence and "determined by triangulation," and which for so many years have been acknowledged as marking the boundary line between the city of Waltham and the town of Lexington.

Therefore, your commissioners hereby locate and define the boundary line between the city of Waltham and the town of Lexington to be as follows: —

Beginning at a point common to the adjoining municipalities of Waltham, Lexington and Lincoln, and marked by an appropriate stone monument having the letters "W. L. L." cut thereon, and situated in north latitude 42° 25′ 28.18″ and in west longitude 71° 16′ 08.80″, and running thence in a straight line, the true course of which is south 66° 08′ east, a distance of 16,529.9 feet to a point common to the adjoining municipalities of Waltham, Lexington and Belmont, and marked by an

appropriate stone monument having the letters "W. L. B." cut thereon, situated in north latitude 42° 24′ 22.07″ and west longitude 71° 12′ 42.31″, said line to be hereafter regarded as the true and correct boundary line between the city of Waltham and town of Lexington.

Respectfully submitted,

(Signed) HENRY L. WHITING.
DESMOND FITZGERALD.
ALFRED E. BURTON.

The report on the boundary line between the towns of Melrose and Stoneham is as follows: —

COMMONWEALTH OF MASSACHUSETTS.

TOPOGRAPHICAL SURVEY COMMISSION,
OFFICE, COMMONWEALTH BUILDING,
11 MT. VERNON STREET, BOSTON.

To His Excellency FREDERIC T. GREENHALGE,
Governor of Massachusetts.

Your commissioners beg leave to present the following report in reference to the requirements of chapter 182 of the Acts of 1895, viz., "An Act to locate and define the boundary line between the towns of Melrose and Stoneham," as follows: —

SECTION 1. The commissioners on the topographical survey and map of Massachusetts, after hearing parties interested, upon proper notice, are hereby authorized and directed to

locate and define the true boundary line between the town of Melrose and the town of Stoneham, as established by chapter forty-five of the Acts of the year eighteen hundred and fifty-three and by other statutes now in force in relation thereto, and to mark said boundary line by appropriate monuments. The boundary line thus located and defined shall be the true and correct boundary line between said towns of Melrose and Stoneham.

SECT. 2. This act shall take effect upon its passage. [*Approved March 27, 1895.*

In execution of the work assigned to them, under the requirements of the Resolves of 1885, chapter 29, "to define by triangulation the boundary lines of the cities and towns of the Commonwealth," your commissioners had already fixed the position of the points in the boundary line between the towns of Melrose and Stoneham, as pointed out to them by proper authority, and have since fixed the position of the so-called "Wilson stone" or bound, and have found no reason to question or change the location of the existing monuments that mark the line in question.

In accordance with the requirements of chapter 182 of the Acts of 1895, before cited, your

commissioners met at the office of the selectmen of the town of Melrose at 2 o'clock P.M. on May 21, 1895, and held a meeting for the purpose specified and heard the testimony of persons interested in the subject.

After consideration of the facts and circumstances of the case, your commissioners can see no reason for changing the boundary line between Melrose and Stoneham as defined by the last act of the General Court in relation thereto, viz., chapter 45 of the Acts of 1853; and therefore, in accordance with the provisions of chapter 182 of the Acts of 1895, the topographical survey commissioners hereby locate and define the boundary line between the towns of Melrose and Stoneham to be as follows: —

Beginning at a point marked by an existing monument at the "corner" common to the adjoining towns of Melrose, Stoneham and Malden, determined by triangulation by said commissioners to be in latitude 42° 26′ 38.39″ and in longitude 71° 04′ 57.41″; thence running in a straight line, the true bearing of which is north 6° 57′ 59″ east, a distance of 6,501.68 feet to a point marked by an existing monument, known as the "Wilson stone," in latitude 42° 27′ 42.14″ and in longitude 71° 04′ 46.89″; thence running in a straight line, the true bearing of

which is north 3° 32′ 52″ east, a distance of 4,517.52 feet, to a point marked by an existing monument at the "corner" common to the adjoining towns of Melrose, Stoneham and Wakefield, in latitude 42° 28′ 26.68″ and in longitude 71° 04′ 43.16″, said line to be hereafter regarded as the true and correct boundary line between the town of Melrose and the town of Stoneham.

Respectfully submitted,

(Signed) HENRY L. WHITING.
DESMOND FITZGERALD.
ALFRED E. BURTON.

As the work of the boundary line survey has become more generally known and its accuracy tested by persons having to do with various public work in connection with which its results would be of value, the application for information in regard to it has much increased, and the work of responding to these calls has become quite an item in the operations of the office. In record of the amount of data furnished during the years 1894 and 1895 the following statistics are submitted, and show the wide range of useful purposes to which the accurately determined results of this State work can be and are being applied : —

Data given to Engineers and Public Boards, 1894.

J. N. McClintock, C.E., Boston.

Tracing of part of the original New Bedford sheet.

Duplicates of sketches of New Bedford corners.

Positions of town corners and △n. points in the town of Swampscott.

Positions of town corners and △n. points along the coast from Revere to Lynn.

Frederick T. Fuller, Weston.

Number of acres of marsh land between Concord River bank and the 20-foot contour line in Bedford.

G. R. Cook, Cambridge "Tribune."

Areas of Fall River, Lynn, Cambridge, Lowell, Quincy and all of Suffolk County.

State Board of Health and Metropolitan Water Supply.

Tracings of sections of Fitchburg, Marlborough, Lawrence, Boston, Framingham, Barre and Worcester, from original topographical sheets.

C. W. Howland, C.E., Rockland.

Angle of town line at the south-west corners of Hingham and Weymouth.

F. S. Hunter, resident engineer Old Colony Canal Company.

Position of Bourne's Hill, Sandwich.

Positions, azimuths and distances of one Waltham corner and of two △n. points in the same town.

H. L. Smyth, Harvard College.

Positions and azimuths of four △n. points in and around Cambridge.

G. W. Allen, East Bridgewater.

Tracing of East Bridgewater town plan.

F. P. Johnson, city engineer of Waltham.

Positions of Waltham corners and △n. points on the Waltham-Belmont line.

Azimuths and distances between two Waltham corners and one △n. point, also azimuths on the Waltham-Newton line.

Boston Water Works.

Positions of all corners of Natick and Hopkinton and corners on the Ashland-Holliston, Ashland-Sherborn and Framingham-Sherborn line.

Positions of all the corners of Southborough and corners on the Ashland-Framingham, Framingham-Wayland and Framingham-Sudbury lines.

E. A. W. Hammatt, C.E., Boston.

Azimuth between Hyde Park corners 9 and 10.

H. S. Adams, C.E., Boston.

Tracing of town plan, positions of corners and △n. points in and around Arlington.

G. W. Tower, Harvard College.

Tracing from original sheets of vicinity of Blue Hills.

W. A. Clapp, Winchester Water Board.

Positions of corners and △n. points and plan of the town of Winchester.

Oliver J. Lane, selectman of Bedford.

Outline plan of Bedford, showing corners and △n. points.

JAMES BANCROFT, C.E., Reading.

Outline plan of Reading, showing corners and △n. points.

PHILIP BORDEN, city engineer, Fall River.

Tracing of city of Fall River, and positions, azimuths and distances of corners.

CALVIN W. POOLE, C.E., Rockport.

Positions, azimuths and distances of corners of Rockport, and △n. points in the vicinity.

L. M. HASTINGS, city engineer, Cambridge.

Positions, azimuths and distances of corners and positions of △n. points in Waltham, Lexington and Belmont, and large plan of above towns.

J. H. STANWOOD, Massachusetts Institute of Technology.

Sketches of three Revere corners.

OLMSTED, OLMSTED & ELIOT, Brookline.

Positions of corners of Medford and Stoneham.

METROPOLITAN PARK COMMISSION.

Areas of towns around Boston, with planimeter. Positions of corners of Bedford, Burlington, Lincoln, Wayland, Weston, Wellesley, Natick, Millis, Dover and Lexington. Tracing of wooded areas from Boston, Franklin, Abington, Dedham, Framingham and Boston Bay original sheets.

UNITED STATES COAST SURVEY.

Positions and descriptions of all town corners and △n. points around Boston harbor and along the coast from Swampscott to Scituate, — 311 points in all.

T. T. H. HARWOOD, United States engineer's office.

Positions and tracings of corners and △n. points near the Merrimac River, from Haverhill to the coast.

CHARLES W. MASON, United States hydrographer.

Descriptions of four Newburyport, two West Newbury, two Groveland, two Haverhill and four Amesbury corners.

RICE & EVANS, Boston.

Tracing from the Middleborough original sheet.

FRENCH & BRYANT, Brookline.

Positions and descriptions of all town corners and △n. points in the vicinity of the Blue Hills and in the Middlesex Fells park reservation.

ARTHUR BANCROFT, C.E., Stoneham.

Positions of corners of Stoneham and tracing of the town plan.

WALTER C. STEVENS, C.E., Melrose.

Diagram, azimuths and angles of Melrose corners 1, 2 and 3, and one △n. point.

FREDERICK ENDICOTT, Canton.

Positions, azimuths and distances of the Stoughton-Canton line and four △n. points.

NASH & HUNTER, Boston.

Positions of the corners of Weymouth.

Data given to Engineers and Public Boards, 1895.

G. A. CARPENTER, city engineer, Pawtucket, R. I.

Positions of three Attleborough corners and nine △n. points in the vicinity.

C. W. HOWLAND, C.E., Rockland.

Positions of corners and △n. points of Rockland and Whitman. Azimuths and distances from corner to corner of Rockland and Whitman.

Positions of corners of Hingham, Marshfield, Hanover and Hanson, with positions of △n. points in the vicinity.

NASH & HUNTER, Boston.

Positions and sketches of △n. points in the vicinity of Weymouth and Hingham.

F. W. BATEMAN, C.E., Clinton.

Positions, azimuths and distances of △n. points in the vicinity of Georgetown and Groveland.

RICE & EVANS, Boston.

Sketches and positions of △n. points and town corners from New Bedford to Middleborough.

Positions of Mattapoisett, Acushnet and Rochester corners.

BOSTON WATER WORKS.

Positions of △n. points in the vicinity of Woburn, Winchester, Stoneham, Wakefield, Reading and Wilmington, and corners of Woburn, Winchester, Stoneham and Wakefield.

HORACE E. WARE, Boston.

Tracing of the Neponset water-shed from Franklin and Dedham original sheets.

G. F. HARTSHORN, C.E., Woburn.

Positions of Woburn and Stoneham corners, and tracing of the Woburn town plan.

F. C. COFFIN, Boston.

Tracing from part of the Providence original sheet.

METROPOLITAN PARK COMMISSION.

Tracings of sections of wooded areas from the following original sheets: Lowell, Lawrence, Salem, Framingham, Boston and Boston Bay.

Positions and azimuths of two Braintree corners and one △n. point.

Positions, azimuths and distances from corner to corner around Watertown, and tracing of the town.

Positions, azimuths and distances of three Dedham corners.

Sketch of Newton corner 2.

Position of Blue Hill △n. point, two corners and three △n. points, with azimuths and distances, in Quincy.

MOORE & CO., Boston.

Copies of parts of Boston Bay, Boston, Abington and Dedham sheets.

CAMBRIDGE WATER BOARD.

Tracing of part of the original Framingham sheet.

T. HOWARD BARNES, C.E., Medford.

Positions and sketches of one Medford corner and four △n. points.

Positions, azimuths and distances of corners on the Medford-Winchester line.

Positions, azimuths and distances of five △n. points in the vicinity of Medford.

F. L. FULLER, C.E., Boston.

Positions, azimuths and distances of the corners of Wellesley.

G. O. SERVICE, Somerville.

Tracing of town line and △n. points of Somerville.

STATE BOARD OF HEALTH.

Positions and azimuths of town bounds on the Charles River in the following towns and cities: Boston, Newton, Watertown, Weston, Wellesley, Needham, Brookline and Waltham.

Tracing of part of the Lowell original sheet.

Sketches, descriptions, azimuths and distances of △n. points and corners in Wellesley and Newton.

Positions of Milton, Dedham, Hyde Park, Needham, Dover and Wellesley corners.

Positions, azimuths and distances of three Quincy corners.

E. A. W. Hammatt, Boston.

Positions of all △n. points and corners of Hyde Park.

Positions, azimuths and distances of eleven △n. points in and around Belmont.

Positions of all the Belmont corners, with sketches of the same.

N. Spofford, C.E., Haverhill.

Positions of three △n. points in the vicinity of Haverhill.

G. L. Mirick, C.E., Malden.

Positions of all the Malden corners, and tracing of town plan.

W. L. Webber, city engineer, Gloucester.

Positions of all the △n. points and corners of Gloucester.

Metcalf & Desmond, New Bedford.

Positions of all the corners of Acushnet, Freetown, Rochester and Bourne, and azimuth and distance between two △n. points.

Walter C. Stevens, C.E., Melrose.

Positions, azimuths and distances of three Saugus corners and one △n. point.

James A. Bancroft, C.E., Reading.

Positions, azimuths and distances of four Stoneham corners.

Edward W. Lydston, city engineer, Everett.

Positions, azimuths and distances of five Everett corners.

Newcomb B. Tower, clerk of Board of Selectmen, Cohasset.

Positions of corners and tracing of town of Cohasset.

F. H. Kendall, county engineer's office, East Cambridge.

Tracings of all the town plans then determined in Middlesex County.

W. G. Spear, Quincy.

Tracing of town lines of Quincy, Braintree, Randolph and Holbrook.

Charles River Improvement Commission.

Positions of corners on the Newton-Boston and Dedham-Boston line.

Positions, azimuths and distances of seven Hyde Park corners.

W. I. Vinal, assistant United States Coast Survey.

Positions of four Bourne corners.

W. A. Clapp, Winchester Water Board.

Positions, azimuths and distances of seven △n. points around Winchester.

E. P. Adams, C.E., Boston.

Positions, azimuths and distances, sketches and descriptions of six Stoneham corners and five △n. points in the vicinity.

French & Bryant, Brookline.

Positions, azimuths and distances of corners and two △n. points in Salem.

Positions, azimuths and distances of three Belmont corners and two △n. points.

W. S. Rhodes, Massachusetts Institute of Technology.

Tracings of town plans of Medfield and Walpole.

Metropolitan Water Board.

Positions, azimuths and distances of twelve △n. points in the vicinity of Marlborough and tracing of sketch of triangulation. Six of these points were specially determined for the Board.

Dr. W. J. Keith.

Tracing of triangulation sheet from Blue Hill to Copecut and from Manomet to Beaconpole.

J. N. McClintock, C.E., Boston.

Positions, azimuths and distances of all the New Bedford corners, also positions of five △n. points, with tracing of the outline of the city.

Chairman of the selectmen of Westport.

Tracing of the town line of Westport, with the position of Westport corner 3.

G. A. Kimball, Boston.

Areas of the town of Peabody and of the city of Salem.

In connection with his work of computing the "inverses" of the various town boundary lines, Mr. W. C. Hawley, one of the assistants of the commission, reported to the chairman of the Board the fact of the difference in the value of the logarithm for converting meters into feet, that used prior to 1891 being 0.5159889, and that given since, by the Coast and Geodetic Survey, being 0.5159842, asking for an explanation of the question, and instructions as to which logarithm to use in his future computations.

As the Coast and Geodetic Survey has taken much interest in and given valuable aid to the work of the State Boundary Survey, the chairman of the Board submitted Mr. Hawley's letter to the superintendent of that Bureau, with a

request for the favor of the consideration and answer to the question.

The following letters from General Duffield and Professor Schott are valuable contributions to the support of the State Survey: —

UNITED STATES COAST AND GEODETIC SURVEY,
WASHINGTON, D.C., Nov. 22, 1895.

Mr. HENRY L. WHITING, *Assistant United States Coast and Geodetic Survey, and Commissioner Topographical Commission, 11 Mt. Vernon Street, Boston, Mass.*

SIR: — I have the pleasure of enclosing herewith a memorandum from the chief of the computing division, containing the information requested in your letter of November 30, and also a copy of "conversion tables."

Respectfully yours, W. W. DUFFIELD,
Superintendent.

COMPUTING DIVISION, COAST AND GEODETIC SURVEY, Nov. 22, 1895.

Memorandum in reply to letter of Assistant H. L. Whiting, dated Boston, October 30: —

The following remarks are in answer to letter of Mr. W. C. Hawley of the Massachusetts State Survey.

The logarithm 0.5159842 for converting metres into feet is correct; it conforms to the best and latest ratio known between these standard lengths.

The value of this ratio used before 1891 was

0.5159889, which corresponded to the best value then.

The metre has not changed, and will never change in value ; it is the same length now it was nearly one hundred years ago, and the Coast Survey never used any other standard unit of length.

In reply to the categorical questions : —

(1) Use the logarithm 0.5159842.

(2) The same as above, or 1m. = 3.2808333 feet, and this is the latest equivalent.

(3) There being *no* old metre, the Massachusetts Survey was based upon *the* metre ; the lengths of base lines have always been expressed in metres, hence there was no occasion for any change or conversion.

It was the Massachusetts Survey that converted the given length of the triangulation from metric to English measure.

The difference between the old and new *ratio* is so small that it cannot affect seriously any of the results of the State Survey, as it is less than two-thirds of an inch per statute mile.

The accompanying official table of units of measure and weights fixes the date of change in the above ratio.

Respectfully submitted by

CHAS. A. SCHOTT,

Assistant.

In explanation of the general conduct of the field work of the commission, the reports to the Board of the chiefs of the three surveying parties are submitted, omitting only such minor details as refer to the routine affairs of the commission. The following is the report of Mr. C. H. Van Orden, of the United States Coast and Geodetic Survey : —

To HENRY L. WHITING, *Chairman*,
Massachusetts Topographical Survey Commission.

SIR : — I have the honor to submit the following brief report : —

On Aug. 14, 1895, I was called to the office of the commission to assist in examining the town boundary atlas sheets being prepared for duplication, in order to determine the style of representation and the method of reproduction. I was asked, at the same time, to look over the computations and general office matters.

I assisted in examining a large number of atlas sheets, and found that the general character of the work done was good.

I was also asked to again look into the cheaper methods of duplication that would give satisfactory results. I examined several of the methods in use, such as printing on sensitized paper, heliotype, bromide enlargement from small negatives, etc., and I unhesitatingly recommend the regular litho-

graph as giving the best results, and the cheapest where a large number of copies are required.

I was in the office on the 14th and 15th of August, and while there the commissioners held a meeting at which I was directed to inspect the field parties without notifying them of the time of my intended visit, and after my field inspection to again report to the office, and note the condition and progress of the general work.

In carrying out my inspection duty, after first getting from the office the field address of Mr. Tolley and Mr. Peirce, I reached Springfield on September 23 and Northampton on the 24th, where, at the latter place, I found Mr. Peirce occupying the triangulation station "Chestnut Hill," a high hill eight or ten miles further up the Connecticut valley. At this station I made a number of "pointings" on signals, in order to get a correct idea of that part of the general scheme of work. From what I could see from this hill, and from examination of the sketch of the triangulation, I regard the lay-out of the work as good; I also found that Mr. Peirce's angles were accurately and well measured. Mr. Peirce had done a large amount of good work, and has been very industrious in its execution. He had experienced some loss of time on account of the town boundaries not being already properly marked.

At Fitchburg I met Mr. Tolley, but was not able to go into the field with him without much delay to his work, as he was about moving his party to one of his extreme north-westerly stations that would overlook but a small part of the work already done. This being large triangulation, the examination of his plan of work, together with his maps and sketches, was sufficient to give me a good understanding of his operations, and enables me to report the fact of the lay-out and execution of an excellent scheme of work.

I take this occasion to further testify to the extreme care and accuracy with which this general scheme of the Massachusetts town boundary triangulation has been projected and executed, and believe it will prove of lasting value and credit to the State and the commission.

Very respectfully submitted,

C. H. Van Orden.

The following is the report to the Board of Mr. James B. Tolley: —

Prof. Henry L. Whiting,

Chairman Topographical Survey Commission.

Dear Sir: — I herewith submit to you my report of the field work done for the town boundary survey the past season, 1895. As per letter of instructions from you, dated April 26, I had assem-

bled at the office in Boston on May 3 the men that were already engaged to assist me in the field work. At a meeting of the commission on May 2 it was decided to have the Wilson bound determined, said bound being in the line of contention between the towns of Melrose and Stoneham. On that date I received instructions from you to proceed with my party upon the field and ascertain the geographical position of this Wilson bound. I therefore moved to Wakefield on May 3, and in three days reconnoitered, erected the necessary signals and made sufficient observations upon the newly established station to ensure an accurate determination of this bound stone.

The records of this field work were turned over to the office corps and were immediately computed, showing excellent results. Acting under orders from you, I proceeded, upon the close of the Wilson bound work, to execute the primary triangulation decided upon. I commenced this work upon May 8, and erected a first order signal upon Castle Hill. After completing the building of first order signals over the primary points of the United States Coast Survey and Borden Survey, I began taking observations on May 19 at Prospect Waltham. The lines from this station varied from about ten miles to forty miles in length, as they did from all the main stations. I had no trouble

in seeing my signals ten miles off, with the atmosphere that we usually had; but when I found it necessary to point upon signals twenty miles off and over I had to resort to the use of the heliotrope, which made the work progress more slowly. As I had but two heliotropes, I could only measure the angle between the two stations where the heliotropes were posted. It is proper for me to state that I did not rely wholly upon the heliotrope for getting my long lines throughout the season. As I arrived at my stations early in the morning and remained until late in the day, it gave me an opportunity to measure a great many angles by pointing at the signal poles. The atmosphere in the early and late hours of the days is in its best condition for making accurate observations; the air is clearest at this time, and there is less refraction to affect the uniformity of the angles observed. The past season was fairly favorable for triangulation work, but there is always more or less density in the atmosphere during the summer, often preventing more than two whole days of consecutive good seeing. In this primary triangulation I had the following stations to determine, viz.: Robins Hill in the town of Chelmsford, Wachusett in Princeton, Pegan Hill in Natick, Marlborough in Marlborough, Maynard in Maynard, Miscoe Hill in northern Mendon, Chestnut

Hill in southern Mendon, Bumskit in Paxton, Lunenburg Hill in Lunenburg, Gibbet Hill in Groton, Bare Hill in Methuen, Ayers Hill 2 in Haverhill and Bald Pate Hill in Georgetown. I also determined the following natural points, such as church spires, etc., viz.: Crosses House Pole in Lunenburg, Pearl Hill Observatory in Fitchburg, Marlborough Water Tower in Marlborough, Billerica Unitarian Church, Northbridge Congregational Church, Sutton Church, Hopkinton Church and Leicester Church.

To determine the above points I occupied the following United States Coast Survey and Borden stations, viz.: Prospect Waltham in Waltham, Holt in Andover, Fays Mountain in Westborough, Castle Hill in Saugus, Watatic in Ashburnham and Mugget in Charlton. I had no positive means of identifying either one of the United States Coast Survey and Borden points, and in order to secure them, together with the new primary points I had previously determined, I deemed it important to make a thorough record of their location by establishing a sufficient number of witness marks and a permanent mark for the station proper, in the usual manner adopted in our Massachusetts triangulation.

There was much uncertainty as to the correct position of the original coast survey and Borden survey station on Wachusett Mountain, and re-

ports had been made to the coast survey office that the position of the original station and the witness marks referring to it had been lost. I made special effort to ascertain these facts. I could find no evidence of the true position of the original station point. It was on a detached shelving rock, about three by five feet in size. There was a report that this rock had been selected and moved by laborers for the purpose of a foundation stone to the building put up on the top of the mountain. This purpose, however, was afterwards abandoned, but the question remained whether or not the stone had been moved from its original position. I thought it best, however, to erect and determine a signal over the point as we found it, as a signal had of late years been over this same point, and its position was woven in with our scheme of triangulation. With the description of this station and its witness marks, furnished from the office of the Coast and Geodetic Survey, as a guide to my researches, I was, after careful examination of the ground, enabled to identify one of the original witness marks. With this point as a further guide, I discovered the position of the other two witness marks. The measurements, distances and directions from these points, according to the description given, intersected accurately at a centre point on the rock,

which was conclusive evidence of the position of the original station. This is a most satisfactory result, and will be of great value in accurately connecting our State work with the main triangulation of the former surveys."

[*Note.* — The commissioners will report to the superintendent of the Coast and Geodetic Survey the results of Mr. Tolley's careful and successful operations in recovering the supposed lost position of this important station.]

"At a meeting of the commission, held on August 15, it was decided to have me determine some points for the Metropolitan Water Board after the completion of Wachusett station. On September 6 I moved my party to Clinton; after reconnoitering the country I found it was necessary to erect three large signals in order to determine the two signals the Metropolitan Water Board had erected. I thought it important to make the work strong, as they based their survey upon the results of our work. There was a divide, or high ridge of land, thickly wooded, running from Shrewsbury north and through the western part of Northborough, that shut off the Metropolitan Water Board scheme from our stations and base lines. I met with considerable difficulty in carrying the triangulation over this ridge. I closed the Metropolitan Water Board

work on September 21. The record books containing the survey were sent to the office of the commission for revision, with memoranda in regard to the computations which followed; and in due time the geographical positions and distances were given to the Metropolitan Water Board. On September 13 I moved my party to Ashby, and resumed the primary triangulation by occupying Watatic station.

I finished Watatic station on Oct. 7, and moved to Sterling, in the eastern part of Worcester County, and took up the regular town boundary work, beginning where I left off on Dec. 13, 1894. My base lines here were partly those I determined for the Metropolitan Water Board and those that I carried down from the Wachusett and Watatic base. It took me quite a little time to erect the necessary signals, ascertain the proper bound stones to determine, etc., before I could begin taking observations. I was unable to get perambulations of the town lines I determined this season. The selectmen, however, were very obliging, and went or detailed some one to show us the corner and angle stones. I will here mention that the bound stones between western Lancaster and eastern Leominster and Sterling were not up to the standard in size and quality. They no doubt were the original bound

stones of these old towns, which probably accounts for their inferior quality. They were the common slate stones, varying in height from three to five feet, and averaging about 1.50 feet in width, while they were only from two to four inches thick. Each stone was properly marked, however, with good plain letters cut in it. For the primary triangulation I used the eight-inch theodolite No. 152, belonging to the United States Coast Survey. It is a very fine three-vernier instrument, the limb graduated to five seconds, with an azimuth compass which can be placed on top and parallel with the axis of the telescope. This compass I used at nearly all of our primary stations, connecting the witness marks with the magnetic bearing and our triangulation points, giving, as you will observe, *the variation of needle at these various stations in central Massachusetts.* At each station this instrument (No. 152) was sheltered from the sun and wind by an observing tent, the instruments giving excellent results.

For the town boundary triangulation, running traverses, occupying church spires, cupolas, etc., I used the seven-inch Buff & Berger theodolite No. 1446, belonging to the Massachusetts State Survey. This instrument also gave good results.

The steel tape I used for town boundary work is graduated to meters, decimeters, centimeters and millimeters. In all my measurements for the witness mark to main stations I used a tape graduated to feet and hundredths of a foot. I think it unnecessary for me to describe my mode of signal building and the manner in which I do my field work, as I have heretofore given it in detail to the commission.

I had with me during the entire season Mr. W. D. Adlington as foreman of my party; as assistant, Mr. W. C. Harlow from May 3 to May 10, Mr. G. W. Rogers from May 10 to December 1, and Mr. Harold B. Mayhew from July 1 to December 1. They all rendered excellent service throughout the season. I wish to make special mention of Mr. Mayhew's proficiency in sketching the triangulation monuments and the town boundary monuments.

The following is a summary of the season's work. The names of the towns completed are Sterling, Lancaster and Clinton: —

Number of towns determined (completed),	3
Number of bound stones determined,	41
Number of signals built,	85
Number of stations occupied,	111
Number of traverse stations,	38

Number of bases used in small triangulation,	10
Number of angles measured,	13,761
Number of triangulation points determined,	105
Number of triangulation points sketched and marked,	21

Very respectfully submitted,

JAMES B. TOLLEY.

The following is the report to the Board of Mr. Eugene E. Peirce: —

To the Chairman of the Topographical Survey Commission.

SIR: — I have the honor to submit the following brief report of the field work done by me in the Connecticut valley during the season of 1895, in accordance with your instructions, dated April 25, 1895.

My party was organized and took the field on May 1, and closed work on December 7. In laying out my season's work I decided on confining my triangulation to the determination of the bounds of the cities and towns lying near the Connecticut River; the contour of the valley being such that the scheme comprised a strip the width of one town on the west and two towns on the east of the river; included in this section were the cities of Springfield, Chicopee, Holyoke and Northampton. As instructed, I commenced operations at the Massachusetts-Connecticut State

line, and worked northerly, making my headquarters at Springfield. As is usual, my first duty was to obtain a perambulation or description of the town lines to be surveyed.

From the start it was evident that the records of perambulations in this part of the State were very imperfect; it was impossible to get any description whatever in many cases. Among those I was successful in obtaining, however, I found that the angles in some of the lines were marked by a "pile of stones," "a blaze on a dead tree," "two walnut trees," "black oak stump ten feet high, badly decayed, with stones around it," "two small hickory trees with stones," etc. With such a condition of affairs, and nonconformity with the law in relation to the marking of town lines, it was evident that some decisive action should be taken to have the angles suitably marked, in order that our survey could be properly made.

Acting on the suggestion of your Board, the Attorney-General sent a circular to the selectmen of those towns where proper bounds were lacking, asking that the law be complied with. I wish to mention the special interest shown in setting the bounds by Selectmen Towle and Granger of Westfield, and Mr. Aldrich of the Board of Selectmen of Granby.

The mountain ranges form the boundaries between a number of the towns in this section, the lines following "the highest part of the mountain." As it would be a very expensive and arduous task to get stone monuments of sufficient size to the summit of the mountains, your Board, with the advice of the Attorney-General, decided that, wherever an angle occurred in a town line in an inaccessible place, an iron post could be substituted. These iron bound marks were made under my direction at the H. B. Smith Foundry in Westfield, and consisted of a two-inch iron pipe four feet in length, surmounted by a cast-iron cap six inches wide, on the opposite sides of which were cast the letters of the respective towns between which the post was a bound. Wherever it was possible, these iron bound marks were screwed onto a one and three-eighths inch steel rod, leaded into a one and one-half inch hole drilled one foot deep into an outcrop of ledge or large rock, showing its top a little above the surface of the ground. In cases where this method could not be used, the two-inch pipe was cut six feet in length, on the base was screwed a cap through which two iron rods each two feet in length ran at right angles; a hole two feet deep and about two feet in diameter was then dug in the ground; when the post was set up

vertically the rods lay horizontally on the bottom of the hole, the hole was then filled with Portland cement, which, when hardened, made a firm bed for the post to set in, the iron rods holding it in place. The posts and caps are painted white, with the exception of the letters, which are black, and are easily distinguishable through the trees in wooded places for long distances.

On the following town lines bound marks were set under my direction during the season, at angles and corners where no proper bounds existed prior to 1895: —

For the entire line of Amherst-Granby, seventeen iron and two stone posts were set; in Amherst-South Hadley, three iron and one stone post, marking the entire line; Hadley-South Hadley, seven iron and one stone post; Hatfield-Whately, two stone posts; Granby-South Hadley, seven stone posts; Holyoke-Southampton, two stone posts; Westfield-West Springfield, fifteen iron posts; Agawam-Westfield, seven iron and two stone posts; Agawam-Southwick, thirteen iron and two stone posts; total, sixty-two iron and nineteen stone posts.

In going over the Massachusetts-Connecticut State line, on the southern boundaries of Hampden, East Longmeadow, Longmeadow and Agawam, I found that in almost every case the bounds were

small sandstone monuments, ranging in height from one and one-half to three and one-half feet, very few being over two and one-half feet high, evidently set only one or two feet into the ground, and badly defaced.

On the boundary between Agawam (Mass.) and Suffield (Conn.), two of the angles in the *State line* were unmarked, and therefore they could not be determined. In laying out the scheme of triangulation it was evident that a number of high signals would be necessary over the bounds lying in ravines or in heavily wooded sections. I was obliged to build one signal at the corner of Belchertown-Granby-Ludlow, one hundred and ten feet high, the other larger ones ranging from fifty to ninety feet in height.

At the primary points signals were built of sawed spruce, four by four masts with three by four braces for the tripods ; three by three masts, with four two by three braces at the secondary, and two by two masts with four one by two braces at the tertiary points. The masts were painted in alternate stripes of black and white, two or three feet in length.

I carried my triangulation as far north as the southern boundary of Franklin County, leaving out those lines which were improperly marked to be completed later in the season, when the bounds would be in place.

My headquarters from the middle of July to the first of November were at Northampton. On November 6 I returned to Springfield, where I remained until the close of the season.

I have been greatly retarded in the progress of my work the past summer and fall in consequence of so many bounds being lacking, and by the "Connecticut River fogs" and the almost constant hazy condition of the air in the valley, which has been unusually bad during the present season.

The only coast survey station which lay in the territory covered by my triangulation was Mt. Tom, although numerous "Borden stations," the position of which the coast survey has recomputed, were made use of, among them being "High Ridge," "Peaked Mountain," "Hilliard's Knob" and "Mt. Lincoln." There were also available a number of points determined by Assistant F. Walley Perkins of the coast survey, in 1885, but these points were dependent on the recomputed Borden work.

Mr. E. G. Hunt, who has been my field assistant for a number of years, was with me the entire season, and has shown his usual care and interest in the work. Mr. F. E. Tibbetts of West Somerville and Mr. A. D. Butterfield, professor of engineering in the Worcester Polytechnic Institute, were also in my party, the former during the months of May, June, July and August, and the

latter during June and July. Both of these gentlemen did very satisfactory work.

The following statistics show the results of the season's work: —

A. — Town bounds determined,	151
B. — Cities and towns completed,	16
C. — Signals erected (31.50 feet or over),	155
Stations occupied,	150
Traverse stations occupied,	49
Town bounds occupied,	23
Angles measured,	1,598
Pointings made,	32,777
Total geographical positions determined,	338

A. — Five of these bounds are road stones, supposed to be on straight lines between angles, taken in connection with the regular triangulation, without much trouble.

B. — Amherst, Chicopee, Easthampton, East Longmeadow, Granby, Hatfield, Hampden, Hadley, Holyoke, Longmeadow, Ludlow, Northampton, Southampton, Springfield, West Springfield and Wilbraham.

C. — Seven signals were fifty to sixty feet; ten, sixty to seventy feet; nine, seventy to eighty feet; three, eighty to ninety feet; one, ninety feet, and one, one hundred and ten feet high.

Respectfully yours, EUGENE E. PEIRCE.

Mr. Wm. C. Hawley has been almost exclusively engaged during the year in the revision, adjustment and computation of the results of the field surveys and observations. The following is a summary of Mr. Hawley's work: —

The computation of the "inverses" of one hundred and twenty-two cities and towns has been completed. This is the determination, by computation, of the true bearing and distance from point to point in each boundary line, and is a final process after the position of each point in each boundary line has been determined. The number of town "bounds" or "corners" involved in the above work has been 1,784, and the number of lines determined by computation 1,580. In addition to the above, Mr. Hawley has accomplished a large amount of incidental work in computing L. M. Z.'s, reducing eccentric stations to centres, straightening traverses and computing triangle sides, and furnishing data to parties soliciting them. The question of the true relation of the metre to the foot, submitted to the office of the Coast and Geodetic Survey, is a result of Mr. Hawley's careful and thorough execution of his work.

Office Work.

In this department of the operations of the commission the services of Mr. F. E. Bowman have

been of value, owing to his familiarity with the work and records of the field and office. The principal part of his duty has been in connection with the preparation of the town boundary atlases, not only in draughting and plotting, himself, but in preparing material for the other draughtsmen; also in occasional field work, where special details were required. Mr. Bowman has had charge of the distribution of the four hundred atlases of the topographical map provided for public schools. Much of the work of furnishing data and information to the various public boards and to individuals has been in Mr. Bowman's hands.

The report to the commission of Mr. Paul S. Yendell, who has been on duty during the year, shows a large amount of draughting and revision work accomplished, in summary as follows: —

Index map of triangulation and coast line and triangulation map completed. In preparing work for duplication, the following atlas sheets of town boundary surveys have been revised and completed: in Barnstable County, fifteen; in Bristol County, twelve; in Plymouth County, one; in Essex County, twenty-nine; making a total of fifty-seven town boundary atlas sheets. In addition to the above, Mr. Yendell has executed incidental work in connection with the preparation of the town boundary surveys.

As before stated, the pressure of office work in preparation of field results for town boundary atlas purposes necessitated the application of increased force in this department; and on September 27 Mr. F. W. Farnum, an experienced draughtsman, was engaged in the service of the commission. Since this time Mr. Farnum has completed the following work: in Middlesex County, thirty-four town boundary atlas sheets, and has other work in hand.

Mr. F. L. Tibbetts, also an accomplished draughtsman, has been temporarily and occasionally employed, and has completed fourteen town boundary atlas sheets in Middlesex County. Mr. Tibbetts has also done other miscellaneous work in connection with the atlas sheets.

Mrs. E. M. Peirce has continued service for the commission, in her usual systematic, accurate and efficient manner, and her duties have been varied and responsible: in largely assisting in the most important computations; in keeping the financial accounts and books of the commission; in typewriting and in much other incidental office work.

It is proper here to state that all computations and their results are carefully compared and verified by two computers, working conjointly.

From Jan. 1 to about May 1, 1895, Mr. Tolley and Mr. Peirce were engaged in computing and putting in order the notes and data of their field work of the preceding season of 1894, and in making preparation for their coming surveys of the present year.

The boundaries of nineteen cities and towns of the Commonwealth have been surveyed and determined during the present year of 1895. These are as follows: Amherst, Chicopee, Easthampton, East Longmeadow, Granby, Hatfield, Hampden, Hadley, Holyoke, Longmeadow, Ludlow, Northampton, Southampton, Springfield, West Springfield, Wilbraham, Lancaster, Sterling and Clinton.

SUMMARY OF FIELD WORK.

Cities and towns completed,	19
Town boundary points determined,	192
Signals built,	240
Stations occupied,	261
Town bounds and traverse stations occupied,	110
Triangulation points determined, other than town bounds,	302
Triangulation points marked for future use,	39

SUMMARY OF OFFICE WORK.

Triangle sides computed (in duplicate),	2,060
Traverses straightened (in duplicate),	176
Eccentric stations reduced to centre (in duplicate),	382
Inverses computed (in duplicate),	2,370
Field books revised and abstracted,	20

Topographical Survey and Map.

Under the provisions of chapter 83 of the Resolves of 1894, "that four hundred copies of the atlas map of Massachusetts be printed under the supervision of the topographical survey commission, to be distributed under the direction of the State Board of Education to such public schools as they may select in the Commonwealth," etc., the commission would report that the total number of atlases sent out from this office is 393, and that 8 copies remain in their office, subject to the order of the Board of Education.

Under the provision of chapters 95 and 393 of the Resolves of 1894, during the present year of 1895, 25 atlases and 1,710 single sheets of the State topographical map have been sold, for which the sum of $404.78 has been received and the same turned into the State treasury.

Five atlases, in portfolio form, have been gratuitously presented to persons within the ruling of the above resolve.

Financial.

For the expenses of the year now closed, 1895, the commissioners submitted the following estimates, which were approved, and corresponding

appropriations made by the General Court, as follows: —

Determination of boundary lines,	$11,000
Marking boundary lines,	500
Selling and distributing maps,	1,000
Supplementing topographical maps and levelling,	500
Instruments, repairs, etc.,	100
Duplicating atlases of town boundary plans,	1,000
Total,	$14,100

The commissioners have submitted the same estimates for the ensuing year of 1896, with the exception of recommending an addition of $1,000 to the estimate for duplicating the town boundary atlases. The addition of this item is based upon the expediency of putting more force upon this special work of the commission by the employment of additional draughtsmen for that purpose.

In addition to the above amount of $14,100, an appropriation of $500 was made by chapters 182 and 229 of the Acts of 1895, for locating and defining the boundary lines between the city of Waltham and the town of Lexington, and between the towns of Melrose and Stoneham.

The amount appropriated for the general operations of the commission was	$14,600 00
The amount expended under this provision is	13,594 21
Awaiting contract for duplicating maps,	1,000 00
Leaving an unexpended balance of	5 79

The commission desire to call attention to the imperfect and insufficient marking of angle and corner points in the boundary lines of many of the towns of the Commonwealth, such as — quoting from the report of Mr. E. E. Peirce — "a pile of stones," "a blaze on a dead tree," "two walnut trees," etc. That the identification of a given boundary point should be pointed out by proper authorities is a matter of absolute necessity in the proper execution of the State survey. The commission have no authority to enforce the law referring to town boundary markings, which is as follows: —

[Public Statutes of Massachusetts, Chapter 27, Section 5.]

The selectmen of the contiguous towns shall erect, at the joint and equal expense of such towns, permanent monuments to designate their respective boundary lines at every angle thereof (except where such lines are bounded by the ocean or by some permanent stream of water), and wherever a highway crosses such lines. The monuments shall be of stone, well set in the ground, and at said angles, at least four feet high from its surface; and the initial letters of the respective names of such contiguous towns shall be plainly and legibly cut thereon; but it shall not be necessary to erect a new monument at said angles in a place where a permanent stone monu-

ment two feet in height above the surface of the ground already exists.

In order that the law might be carried out, the commissioners asked the advice of the Attorney-General, who at once came to their relief by issuing the following notice to such towns as had failed to comply with the law relating to their boundary lines: —

[Letter of Attorney-General.]

Commonwealth of Massachusetts,
Office of the Attorney-General, Boston, July, 1895.

Mr. ——, *one of the Selectmen of* ——.

Dear Sir: — The Topographical Survey Commission, which is charged, by Resolves of 1895, chapter 29, to determine by triangulation the boundary lines of the cities and towns in the Commonwealth, report to me that many of the angles of the boundary lines between your town and ——— are not designated by permanent monuments, as required by Public Statutes, chapter 27, section 5. The commission requests me to call the attention of your Board to that neglect, and to take measures to enforce compliance with the law.

You are hereby requested to give the matter your attention, and forthwith to establish monuments at all angles, as required by said statute.

Yours very truly,

Hosea M. Knowlton,

Attorney-General.

The commissioners are gratified to state that all the towns that have received the above notice from the Attorney-General have promptly responded to the terms of its request.

In review of the work accomplished by the commission up to the close of the year 1895, the following statement is submitted: —

The number of cities and towns of which the survey of the boundaries has been completed is 228; the number of monuments or bound stones marking the corners and angles in these boundary lines is 2,280; and the number of triangulation points determined in the survey locating these town bounds is 3,576.

The amount received and turned into the State treasury from the sale of the maps of the Commonwealth, from the time of publication to the close of the present year, 1895, is $3,980.23.

In consideration of the subject of imperfect marking of town boundary points, and the great dissimilarity in the marking of even those that may be called sufficiently near to the required character, your commissioners would respectfully suggest the action of the General Court on some measure that may establish some uniform style and kind of mark, which may be recognized by citizens in any part of the Commonwealth as a city or town boundary monument. We would refer, in favor of such a system, to the advan-

tages of the uniform monuments used by the Highway Commission in marking the location of the State roads.

The commissioners desire to express their regret at the resignation from their Board, with the commencement of the present calendar year, of Prof. N. S. Shaler of Harvard University, whose other manifold and arduous public duties obliged him to sever his connection with this commission. Professor Shaler has been identified with its successes since its organization in 1884, where his professional and technical knowledge and experience have been of special value to the Commonwealth.

By action of His Excellency the Governor, Prof. Alfred E. Burton of the Massachusetts Institute of Technology has been appointed a member of the commission, to fill its official quota.

In closing their report, your commissioners are gratified to record the interested and faithful manner in which the members of their organization have performed the various duties assigned to them, and the efforts they have made to economize in all expenditures connected with their work.

They wish further to acknowledge the material aid given to the field parties — working in that

part of the State covered by his system — by President Lucius Tuttle of the Boston & Maine Railroad; also to acknowledge the services of the many members of the boards of selectmen who have assisted the field parties in the prosecution of their surveys.

Very respectfully submitted,

HENRY L. WHITING.
DESMOND FITZGERALD.
ALFRED E. BURTON.